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A SPECIFIC REVISION OF THE GENUS METARRANTHIS (LEPIDOPTERA, GEOMETRIDÆ, ENNOMINÆ)

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The genus *Metarranthis* Warren is one of several genera of the Geometridæ which have never been well understood. The combination of structural similarity of the various species with the tendency to considerable intraspecific variation in size, color, and wing maculation, has been a great barrier to easy and accurate determination. The following descriptions and comments are a result of several years' work with the genus. They are not intended as the final word on the subject, but I believe they may be of considerable assistance in clearing up some of the difficulties which are most likely to be met.

Of the various species now placed in *Metarranthis,* the first to be described was *obfirmaria* by Hübner in 1806. He placed the species in *Epirranthis,* a genus which he had previously created for his species *pulverata.* That *obfirmaria* is not congeneric with *pulverata* was recognized by Guenée in 1857, when he correctly associated *obfirmaria* with *duaria,* placing both in *Numeria.* This association was apparently not generally accepted, and *obfirmaria* continued to be referred to *Epirranthis* until Warren (Nov. Zool. I, p. 436, 1894), also aware of the lack of close relationship between *pulverata* and *obfirmaria* proposed the generic name *Metarranthis* for the latter. Subsequently, Dr. Dyar in his Check List (1902) accepted Guenée's association of *obfirmaria*

with *duaria,* placing them along with *hypochraria,* and related species, in *Gonodontis* Hbn. In 1916, however, Barnes and McDunnough (Contrib. to the Nat. Hist. of the Lepid. of N. A., III, p. 255) pointed out that the male genitalia of the North American species of the *duaria* group are quite unlike those of the old world species of *Gonodontis,* and applied *Metarranthis* to this entire group of North American species. This application marked the beginning of the use of *Metarranthis* in the general sense in which it is now understood.

Metarranthis belongs to a small group of genera occurring in North America and Eurasia, among the North American representatives of which are *Plagodis* Hbn., *Anagoga* Hbn., *Hyperetis* Gn., *Metanema* Gn., *Priocycla* Gn., and *Selenia* Hbn. *Metarranthis* seems, in natural sequence, to lie between *Hyperetis* and *Metanema* as listed. The European genus *Cepphis*, which superficially resembles *Metarranthis,* seems actually to be more closely allied to *Priocycla.*

In McDunnough's 1938 Check List, Part I, p. 169, eight species are referred to *Metarranthis.* One of these, *antidiscaria* Walker, is better referred to *Stenaspilates* Packard, on the basis of both general appearance and structure of genitalia. I have examined the genitalia of a male from Lakehurst, N. J., and of both males and females from Florida, including one of the type series of *lentaria* Hulst, and I find the Lakehurst specimen identical with those from Florida.

In addition to the remaining seven species of the McDunnough Check List, there appear to be at least four more valid species of *Metarranthis.* Two of these, *lateritiaria* Guenée, and *homuraria* Grote, have formerly been considered races of *hypochraria* Herrich Schäffer, but are evidently specifically distinct from that species and from each other. The other two species are described for the first time, I believe, in this article.

Metarranthis obfirmaria (Hübner)

Epirranthis obfirmaria Hübner, Samml. exot. Schmett. II, 219, Tafel 432; Figs. 1, 2, ♂; Figs. 3, 4, ♀. 1806.

Numeria obfirmaria (Hbn.), Guenée, Spec. Gén. X, 135. 1857.

Epirranthis obfirmaria (Hbn.), Packard, Mon. of Geom. Moths, 499; Plate XII, Fig. 7. 1876.

Metarranthis obfirmaria (Hbn.), Warren, Nov. Zool. I, 436. 1894.

Gonodontis obfirmaria (Hbn.), Holland, Moth Book, 350; Plate XLV, Fig. 14, ♂. 1903.

Metarranthis obfirmaria (Hbn.), Barnes and McDunnough, Cont. to the Nat. Hist. of the Lepid. of N. A. III, 255–259; Plate XXXII, Fig. 5 (♂ genitalia). 1916.

Basal and terminal areas of fore wings and most of terminal area of lower wings bright dark reddish brown; median area of fore wings and inner half of lower wings bright orange yellow, sometimes somewhat obscured by a coarse powdering of dark brown scales; antemedial line of fore wings narrow, reddish, curved strongly inward at the costa; postmedial line of fore wings almost straight, dark brown, often preceded by a red or orange line; postmedial line of lower wings dark brown, slightly angulate; discal spots small or missing on fore wings, large and black on lower wings, joined to the base of the wings by a black dash which is sometimes incomplete; terminal area of lower wings showing some bright yellow near the apex; fringes dark brown, concolorous with the terminal area on the upper side. Under side bright orange yellow with reddish brown postmedial lines, and a considerable scattering of reddish brown scales, especially near the apex of the fore wings; discal spots present on all four wings, redder than on upper side. Expanse 1–1½ inches.

Male Genitalia.—Uncus long and slender, bluntly pointed, and scarcely spatulate; left branch of furca stout, moderately long, considerably curved, with two unequal pointed processes at the tip, sometimes with a trace of one or two additional shorter processes at the tip only; right branch of furca similar but shorter; valves rounded with a very slight excavation, or at least a straightening of the edge, along the upper third of the outer margin. Other features are as shown in the drawing.

Female Genitalia.—Genital plate narrow, pointed at both ends. Above and behind this, one on each side of the ostium are two pocket-like formations, smaller and more distinctly quadrangular than in any other species having them. I believe the other features, which show very little difference throughout the genus, are adequately represented in the drawing.

EGG.—Pale yellow, slightly elliptical, flattened above, below, and at one end; scattered loose. There is no color change until just before hatching, when they become dark slate gray.

LARVA.—I have bred this species only once, and then only in rather limited numbers. Hence my observations are too few for generalizations. I found the first stage larvæ to be black with the appearance of six white bands encircling the body, the first between the third and fourth segments of the body, the last between the eighth and ninth. Under a hand lens these bands are seen to be composed of irregularly shaped white spots, closely crowded together. They persist in the second stage, but almost or quite disappear after the second molt.

The mature larvæ were light grayish brown with a paler longitudinal line along the upper side, and four rectangular spots on each segment, the first two on each segment being smaller and almost square, the last two much longer than wide. There were two broken and somewhat obscure dark stripes along each side, but no stripes underneath. Since in several other species of the genus the pattern of the upper side of the larvæ is not constant, it is reasonable to expect various patterns here also. The reported food is *Vaccinium*, but since that was not readily available when I was rearing the larvæ, I gave them choke cherry, which they ate with evident relish.

I am placing *obfirmaria* first in the series of species of the genus, since I believe it to be the most highly specialized species structurally. It is certainly the most brilliantly colored member of the genus, and is not easily confused with any of the others. It is common in acid soil localities in the states of the Atlantic seaboard from Canada to Georgia, and is to be found less regularly farther west. The series in the U. S. National Museum collection contains a single specimen from Kansas.

Metarranthis warneri (Harvey)

Endropia warneri Harvey, Bull. Buff. Soc., II, 121. 1874.
Metarranthis warneri (Harv.), B. and McD., Contrib. to the Nat. Hist. of the Lepid. of N. A., III, 258. 1916.

Upper surface gray with a more or less brownish cast, occasionally somewhat reddish; antemedial line conspicuous, dark brown or blackish, followed by a darker shade; postmedial line

of fore wings dark brown or almost black, straighter than in any other species except *obfirmaria,* but with a slight outward curve or very blunt angulation just below vein M_2, preceded by a darker shade, and followed by a paler line; subterminal shade usually present, sometimes quite conspicuous in the females; fringes concolorous with the terminal area; outer margins of wings rounded; apex distinctly pointed in the females. Under side pale gray with some reddish scales, especially along the veins; transverse lines obscure, sometimes hardly discernible; subterminal shade occasionally present underneath. Expanse $1\frac{1}{8}$–$1\frac{1}{2}$ inches.

Male Genitalia.—Uncus slender and not quite so long as in *obfirmaria;* left branch of furca very stout, ending in two pointed processes, longer and more slender than those at the tip in *obfirmaria;* right branch similar, more slender, and with one additional pointed process considerably below the two at the tip. I have not figured the ædœagus of this species, nor of any of the following species, since there seem to be no essential differences in this structure throughout the genus.

Female Genitalia.—Distinguished by the heavy genital plate, constricted in the middle and tapering to a point at each end. The pocket-like formations are moderately large, kidney-shaped, and quite ragged along the inner edges.

Early Stages.—In June, 1943, Dr. Brewer sent me four lots of eggs from Augusta, Me. These were pink, resembling the eggs of *duaria,* but paler. The newly hatched larvæ had the white bands wider than in any other species seen, and in addition, the thoracic segments and the terminal abdominal segments were almost entirely white. As this is written, the larvæ are in the second and third stages, and the general color is slate gray to gray brown, with a conspicuously mettled darker pattern, intermediate between the usual patterns of *obfirmaria* and *duaria.* They are rather general feeders, but seem to have a preference for various species of cherry and dogwood.

Typical *warneri* is to be found in the New England States and in eastern New York. Some form of the species is to be expected in adjacent parts of Canada and north of the Great Lakes. It has never been reported, so far as I know, from western New York.

Metarranthis warneri race **cappsaria** new race

Metarranthis warneri (Harv.) B. and McD., Contrib. to the Nat. Hist. of the Lepid. of N. A. III, 255; Plate XXIX, Fig. 1, ♂; Plate XXXIII, Fig. 1 (♂ genitalia). (Figured as typical *warneri*.)

Similar in maculation to typical *warneri*, but much darker, with a distinctly sooty appearance over the entire upper surface, and apparently lacking any tendency to redness on the upper side. The dark shade preceding the postmedial line is usually broader than in typical *warneri*, especially on the lower wings. Under side darker than in typical *warneri*, more heavily flecked with reddish scales, and with a wide darker band indicating the position of the postmedial line.

Holotype.—♂, Beulah, Manitoba, May 28. (United States National Museum Collection.)

Paratypes.—5 ♂♂, Cartwright, Manitoba, May and June; 1 ♂, Beulah, Manitoba, May 16, 1902; 2 ♂♂, merely labeled Manitoba (all in the United States National Museum Collection); 1 ♂, Saskatoon, Saskatchewan, June 9, 1934; 1 ♂, McCreary, Manitoba, July 6 (both in Brower collection); 1 ♂, Madison, Wis., June 4, 1932 (in Franclemont collection); 1 ♂, 1 ♀, Hessville, Ind.; 1 ♂, Miller, Ind.; (all in Wyatt collection), 18 ♂♂, Harlan, Sask. May and June (in Bruggemann, Franclemont, and Rupert collections); 1 ♂, Sunnydale, Alta. (in Rupert collection).

Cappsaria is named in honor of Mr. H. W. Capps, who has assisted me greatly by making the material in the National Museum available to me for study, and in preparing many genitalia slides of specimens in that collection.

Metarranthis duaria (Guenée)

Numeria duaria Guenée, Spec. Gén. X, 135. 1857.

Numeria hamaria Guenée, Spec. Gén. X, 136. 1857.

Ellopia ? amyrisaria Walker, Cat. Brit. Museum, XX, 164. 1860.

Caberodes ? agreasaria Walker, Cat. Brit. Museum, XX, 252. 1860.

Endropia adustaria Walker, Cat. Brit. Museum, XXXV, 1545. 1866.

Endropia duaria (Gn.), Packard, Mon. of Geom. Moths, 502; Plate XII, Fig. 10. 1876. (Packard's figure probably represents *franclemonti*, rather than *duaria*.)

Endropia duaria (Gn.), Dyar, Psyche, IX, 371. 1902. (Early stages.)

Gonodontis duaria (Gn.), Holland, Moth Book, 350; Plate XLV, Fig. 2, ♀. 1903.

Metarranthis duaria (Gn.), B and McD., Cont. to the Nat. Hist. of the Lepid. of N. A. III, 255; Plate XXIX, Fig. 4, ♂; Fig. 5, ♀; Plate XXXIII, Fig. 4 (♂ genitalia). 1916.

Metarranthis duaria form *hamaria* (Gn.), B. and McD., Cont. to the Nat. Hist. of the Lepid. of N. A. III, 255; Plate XXIX, Fig. 6, ♂. 1916.

Numeria duaria Gn., Oberthür, Etudes de Lép. Comp., Fasc. XVII, 22; Plate DVII, Fig. 4234 (♀ type). 1920.

Numeria hamaria Gn., Oberthür, Etudes de Lép. Comp., Fasc. XVII, 22; Plate DVII, Fig. 4235 (♀ type). 1920.

Upper surface variable in color, ranging from pale gray through various red-grays to quite dark brownish gray; antemedial line brownish gray to blackish, somewhat blurred, often interrupted at the veins, and rarely almost obsolete; postmedial line similar in color, curving outwardly on the upper half of the fore wings, inwardly below; evenly curved on the lower wings, variable in appearance, usually somewhat blurred, heavier on the lower half of each wing, often interrupted at the veins, sometimes reduced to a series of blurred spots, rarely almost missing; median area concolorous with basal and terminal area; discal spots distinct, blackish, on all four wings; subterminal shade usually present, occasionally distinct across all four wings, but more often reduced to one or two blurred spots on the fore wings, midway between costal and inner margins; fringes concolorous with terminal area, or a bit redder. Under side grayish, more or less flecked with reddish scales; postmedial line reddish, variable in sharpness, sometimes indicated only by a somewhat denser band in the red scaling; subterminal band sometimes present, but obscure. Expanse $1\frac{1}{4}$–$1\frac{5}{8}$ inches.

Male Genitalia.—Uncus narrow, almost as long as in *obfirmaria;* left branch of furca stout, somewhat blunt, ending in many pointed processes, the longest ones at the tip, and gradually becoming shorter along the edges below, not tufted; right branch similar to left branch, but shorter, narrower, and sharper.

Female Genitalia.—Similar to *warneri,* but with the genital

plate much narrower. Too much significance should not be attached anywhere in this genus to apparent differences in the genital plate, since, in the processes of dissection and mounting, it may assume various positions and manners of folding.

EGG.—Yellow, soon turning orange red; not attached to any surface.

LARVA, FIRST STAGE.—Black with only five bands of white spots, the usual sixth one being missing, or at most showing as a faint dot or two on each side; under side uniformly dark; face dark.

MATURE LARVA.—About $1\frac{1}{4}$ inches long; moderately stout; medium to dark brown, with various types of mottling, but never, so far as I have seen, with patches of red. A more or less distinct pale line extends the entire length on the upper side, but no stripes show underneath. The eleventh segment has two rather prominent tubercles, each tipped with a single bristle. I have found choke cherry an excellent food for larvæ of this species, as well as for all the other species of the genus that I have bred. They seem quite willing to take almost any of the *Rosaceæ*, and probably have a rather wide range of food among other trees and shrubs. Dr. McDunnough has reared this species on both blueberry and linden.

Duaria is apparently the most variable in color and distinctness of maculation, the most common, and the most widespread species of *Metarranthis,* ranging in some form or another from the Atlantic to the Pacific in southern Canada and northern United States, as far south as North Carolina in the east, Indiana and Illinois farther west, and Colorado in the mountain region. I have seen Pacific coast specimens only from British Columbia, Vancouver Island, and Washington. Specimens from the western mountains and coast, and from Canada, are in general referable to the race *septentrionaria* Barnes and McDunnough. The red form *hamaria* Guenée seems so completely to intergrade with other forms that I cannot define its limits. Hence I consider it better placed in the synonymy.

Metarranthis duaria, race septentrionaria
Barnes and McDunnough

Metarranthis septentrionaria B. and McD., Contrib. to the Nat. Hist. of the Lepid. of N. A. III, 257; Plate XXIX, Fig. 2, ♂;

Fig. 3, ♀; Plate XXXIII, Fig. 2 (♂ genitalia). 1916.

Distinguished from typical *duaria* by the distinct reddish brown shade preceding the postmedial line on the upper side often more or less covering the median area; by the tendency of the postmedial line to be more sharply defined, not so likely to be incomplete or broken at the veins, and more likely to be followed by a paler line. It is the regular form of *duaria* from the western mountains eastward across Canada to Quebec and the New England states, where it mixes with typical *duaria.*

Barnes and McDunnough mentioned slight differences between the male genitalia of *septentrionaria* and those of *duaria,* but I find these differences difficult to discover, and insufficient to have much significance. They are no greater than the differences frequently found in specimens from the same locality.

Metarranthis angularia Barnes and McDunnough

Metarranthis angularia B. and McD., Contrib. to the Nat. Hist. of the Lepid. of N. A. III, 258; Plate XXIX, Fig. 7, ♂; Fig. 8, ♀; Plate XXXIII, Fig. 3 (♂ genitalia). 1916.

Basal and terminal areas of fore wings, and terminal area of lower wings, reddish brown, about the color of the reddest *duaria;* median area of all wings and basal area of lower wings, much paler yellowish red, coarsely flecked with red and brown scales; antemedial line much as in *duaria,* but redder; postmedial line variable in width, continuity, and completeness, as in *duaria,* more likely to be completely missing than in *duaria,* redder, more angulate, and less in contrast with the terminal area; subterminal shade rarely conspicuous, but often indicated by a spot or two midway between costal and inner margins; discal spots as in *duaria;* fringes fully as red as terminal area. Under side heavily and coarsely flecked with red on a paler background, with no distinct transverse lines, but normally with the median area paler, as on the upper side. Occasional specimens, especially from the southern portions of its range, are much darker than the normal form. I have seen two males, one from Pennsylvania and one from Georgia, which are extreme in this respect, the upper surface being almost uniform dark brown, with the pattern very obscure. Such specimens, however, are not much darker underneath than the normal form. Expanse $1\frac{1}{4}$–$1\frac{3}{4}$ inches.

MALE GENITALIA.—Similar to *duaria* except in the structure of the furca; left branch of furca long, bluntly rounded, with the longest pointed processes below the tip, which is equipped with a tuft of fine hairs; right branch shorter, sharper, with long pointed processes at the tip, and an irregular series of shorter ones, and a few hairs, below.

FEMALE GENITALIA.—Quite similar to those of *duaria,* but usually with the bursa considerably longer.

EGG.—Similar to that of *duaria.*

LARVA, FIRST STAGE.—Dark slaty gray, not so intensely black as in the preceding species, with six bands of white spots, wider than the bands of *duaria.* There is a trace of still another such band between the second and third thoracic segments, and the eleventh segment has a few white spots.

MATURE LARVA.—About $1\frac{1}{4}$–$1\frac{1}{2}$ inches long; brown, less mottled than that of *duaria,* generally grayer, with the characteristic pale longitudinal stripe along the back, and a tendency toward dark, but obscure, longitudinal stripes underneath. The tubercles on the eleventh segment are slightly smaller than those of *duaria.* Food, wild cherry and other *Rosaceæ,* and probably other trees and shrubs.

In spite of its wide range, from Quebec to Georgia, and westward at least as far as Illinois, *angularia* is much less common in collections than *duaria.* It has been confused with *duaria,* but is readily separable by the paler median area, by the coarser "pebbled" appearance of the darker flecking, by the more angulate postmedial line, and usually by the ruddier coloring.

Metarranthis franclemonti new species

Upper surface reddish gray to gray-brown, females sometimes almost neutral gray; antemedial line distinct, reddish, somewhat curved at each end; postmedial line bright reddish to reddish brown, distinct, uniform in width, complete, not interrupted at the veins, outcurved with a slight angulation at vein M_2 of the fore wings, more distinctly angulate on the lower wings; below this angulation, more strongly curved inward and upward than in *duaria;* never preceded nor followed by paler lines or darker shades, although in some specimens the entire median area is paler than the rest of the wings. (In the females the postmedial line is less constant than in the males, occasionally being incomplete, broken at the veins, and heavier along the lower half of each wing. Such females are very similar in appearance to the normal females of *duaria,* but can usually be distinguished by the

angulation of the postmedial line, especially on the lower wings.) Subterminal shade sometimes absent, but usually distinct, occasionally becoming so pronounced in the females as to form a contrasting dark brown band across all four wings; discal spots small, distinct, reddish brown, usually present on all four wings; fringes concolorous with the terminal area. Under side similar to *duaria*, but usually more heavily flecked with red, and with a more distinct postmedial line. Expanse 1¼–1½ inches.

Male Genitalia.—Uncus a little shorter and more spatulate than in *duaria;* furca, symmetrical; both branches ending in a sharp, slightly hairy point.

Female Genitalia.—Distinguished from *duaria* and *angularia* by the much smaller pocket-like formations beside the ostium; from *obfirmaria* by the kidney-shaped form of these processes. The genital plate is wider, constricted at the middle as in *warneri*, but smaller and much less conspicuous than in that species. The bursa is longer than in *duaria*, averaging almost as long as in *angularia*.

Egg.—Similar to that of *duaria*, yellow, soon turning red, less intense than the red of *hypochraria* eggs, but not so orange as in *duaria;* scattered loose.

Larva, first stage.—Black, with six bands of white spots, of approximately equal width. The head and prolegs are dark.

Mature Larva.—About 1–1¼ inches long, similar in color and variable mottling to the larva of *duaria*, but usually darker, and often, but not always, showing patches of bright reddish brown on the upper side; longitudinal pale stripe along the back as in *duaria* and *angularia;* dark longitudinal stripes on the under side of the first two abdominal segments only; tubercles on the eleventh segment smaller than in *duaria* and *angularia*. I have successfully reared three lots of larvæ on choke cherry, but since the species seems to be restricted in distribution to isolated acid soil localities, I suspect the preferred food is something else, possibly *Aronia* or *Vaccinium*.

Franclemonti seems to be rather common in the proper acid soil localities where it flies along with *obfirmaria*. It occurs on the bogs at Passadumkeag, Me., and McLean, N. Y., on the dry hills around Horseheads, N. Y., in the pine barrens around Lakehurst, N. J., and I have seen a few specimens from other localities, the most westerly one from Hessville, Ind.

This species is quite variable, and can easily be confused with both *duaria* and *angularia*. From *duaria* it is most easily separated by the ruddiness and the greater angulation of the postmedial line, and usually by the uniformity and continuity of this line. From *angularia* it can be distinguished by the uniform postmedial line, by the powdery, rather than "pebbled," appearance of the red scaling, and usually by the median area, which is not noticeably paler than the rest of the wings except in occa-

sional specimens, usually from the New England States. I suspect that Packard's figure of *duaria* is based on this species, but, like most drawings, it is too inaccurate for certain determination.

HOLOTYPE.—♂, Lakehurst, N. J., June 4 (Frederick Lemmer). In U. S. N. M. collection.

ALLOTYPE.—♀, Lakehurst, N. J., June 11 (Frederick Lemmer). In U. S. N. M. collection.

PARATYPES.—7 ♂♂, 10 ♀♀, Lakehurst, N. J. (Frederick Lemmer); 44 ♂♂, 23 ♀♀, Horseheads, N. Y. (L. R. Rupert); 6 ♂♂, 2 ♀♀, Passadumkeag, Me. (A. E. Brower); 1 ♂, Bar Harbor, Me. (A. E. Brower); 1 ♂, Hampton, N. H. (S. Albert Shaw); 1 ♂, McLean Res., Tompkins Co., N. Y. (J. G. Franclemont); 1 ♂, Mt. Asnebumskit, Paxton, Mass. (W. T. M. Forbes); 1 ♂, Mt. Wachusett, Princeton, Mass., above 1500 ft. (W. T. M. Forbes). Field specimens are all May and June records. Part of the Lakehurst and Horseheads specimens are bred specimens (April and May). These 97 paratypes are variously distributed in the U. S. N. M., Cornell University, Brower, Buchholz, Franclemont, and Rupert collections.

This species is named in honor of Lieutenant J. G. Franclemont, whose private collection, embracing long series of some of the species, has been completely available to me, and whose cooperation and assistance have been of greatest value to me in this work.

Metarranthis apiciaria (Packard)

Endropia apiciaria Packard, Mon. of Geom. Moths, 502; Plate XII, Fig. 9. 1876.

Upper surface pale yellowish gray; antemedial line of fore wings indistinct, sometimes almost obsolete, followed by an obscure slightly darker shade; postmedial line straighter than in any of the preceding species, brown, preceded by narrow reddish brown shade, with a sprinkling of this color throughout the median area; discal spots brown, distinct and usually present; subterminal shade rather inconspicuous when present at all; fringes reddish brown, at least at the base, and contrasting with the pale terminal area; outer margins of wings scarcely angulate. Under side pale gray with a variable scattering of yellow scales; postmedial line broad, bright reddish yellow. Expanse $1\frac{1}{8}$–$1\frac{1}{2}$ inches.

Male Genitalia.—Uncus shorter than in any of the preceding species, somewhat spatulate, bluntly pointed; left branch of furca moderately long, rather wide at the base, and tapering to a single fine sharp point, very slightly hairy; right branch similar but shorter. Both branches have a peculiar sinuate form not seen in any other species of the genus.

Female Genitalia.—Genital plate wide, not constricted in the middle, strongly upturned and pointed at the ends; pocket-like formations large, very ragged along the inner edge.

I have no knowledge of the early stages.

Apiciaria is apparently one of the less common species of *Metarranthis* in collections but it is known to occur in Maine, Massachusetts, Rhode Island, and New York, and even as far west as Indiana. Structurally it is a very distinct species, and seems, in general, intermediate between the *obfirmaria* group, comprising the preceding five species, and the *hypochraria* group, comprising the following five species.

Metarranthis pilosaria (Packard)

Endropia pilosaria Packard, Mon. of Geom. Moths, 501; Plate XII, Fig. 8. 1876.

Upper surface rich brown; antemedial line of fore wings darker but rather obscure; postmedial line evenly curved, not distinctly angulate, preceded by a darger shade and followed by a paler line; discal spots small but distinct on all four wings; subterminal row of dark spots usually present; outer margins of wings curved without obvious indentations between the veins. Under side orange red to brick red, not obviously flecked; postmedial line narrow, dark brown, followed by a purplish shade. In general *pilosaria* is the stoutest and heaviest species of *Metarranthis*. Expanse $1\frac{1}{8}$–$1\frac{3}{8}$ inches.

Male Genitalia.—Wider, with rounder valves than *apiciaria;* left branch of furca very stout, blunt, strongly recurved at the tip, with many sharp, pointed processes, mixed with some hair; right branch similar, but shorter and sharper.

Female Genitalia.—Unlike any of the preceding species in that they lack the pocket-like formations beside the ostium. The genital plate is wide, uniform in width, and rounded at the ends.

Early Stages.—For what I know of these I am indebted to

the late Mr. Frederick Lemmer who sent me a single full grown larva from Lakehurst, N. J. This larva resembles that of *hypochraria* in shape and structure, but is of a completely uniform dark brown color without mottling or stripes. Mr. Lemmer also wrote regarding the newly hatched larva that it "has 6 rings white, the last one about twice as wide as the rest, and the first one further away from the head than the space between the others." He reports white birch as the food.

All the specimens I have seen of *pilosaria* have come from New Jersey, but it probably has a wider range.

Metarranthis lateritiaria (Guenée)

Endropia lateritiaria Gn., Spec. Gén. IX, 125. 1857.
Endropia lateritiaria Gn., Walker, Cat. Brit. Museum, XX, 151. 1860.

The identity of *lateritiaria* has been one of the most puzzling questions in connection with the study of the genus. The type is supposedly in the Paris Museum and hence at present quite inaccessible. I have examined a photograph of it in the United States National Museum, and have carefully studied Guenée's description, which is none too definite. Either of two conclusions seems reasonable. One is that the name *lateritiaria* is properly applicable to the species described by Packard as *pilosaria;* the other, which I am tentatively accepting, is that it applies to the species described below, which has commonly passed as *lateritiaria* in collections.

Upper surface usually redder than *pilosaria,* postmedial line somewhat variable in the degree of angulation, more angulate than in *pilosaria,* less so than in any of the three following species; subterminal shade present, distinct, quite uniform in width and intensity. Beyond the subterminal shade the wings are paler, often giving the effect of a pale border across all four wings, with the veins finely outlined darker. Under side, somewhat paler than *pilosaria,* smooth orange red, very sparsely flecked darker, and with the dark brown and purple postmedial line more sharply defined. The moths average smaller and slighter than *pilosaria,* and are quite variable in the depth of the marginal indentations between the veins. In the specimen figured they are quite deep; but in other specimens the margins

are as even as in *pilosaria;* more often they are intermediate between the two. Expanse 1–1¼ inches.

Male Genitalia.—Uncus short and spatulate as in the two preceding species; left branch of furca variable in length, sometimes no longer than the right branch; both branches rather sharp with few pointed processes, at the tips only. The two or three processes at the tips are long and slender, accompanied by little or no hair.

Female Genitalia.—Similar to those of *pilosaria.*

I have seen this species from Maine, New Jersey, and intermediate localities, but its range does not apparently extend far inland. It appears to be partial to acid soil localities. The early stages are quite unknown to me.

Metarranthis homuraria (Grote)

Endropia homuraria Grote, Trans. Am. Ent. Soc. II, 80. 1875.
Endropia homuraria (G. and R.), Walker, Can. Ent. IX, 89. 1877.
Endropia homuraria (G. and R.), Grote, Papilio II, 100. 1882.
Endropia amethystaria Strecker, Lep. Rhop. Het. Suppl. 2, 6. 1899.

Upper surface similar to *lateritiaria* in general color; postmedial line narrow, dark brown, and usually very distinct, with angulations much sharper than in *lateritiaria,* often sharper than are usual in *hypochraria,* not always followed by a paler line; subterminal shade inconspicuous and irregular, sometimes indicated merely by a dark smudge adjacent to the angulation of the postmedial line of the fore wing, and making this angulation appear more extreme than it really is; marginal indentations between the veins deeper than in any other species of the genus. Under side similar to *lateritiaria.*

Male Genitalia.—All the male genitalia examined (three in number, from different localities) have the furca symmetrical, with moderately sharp points, both branches tipped with a closely packed cluster of the ordinary pointed processes mixed with a considerable amount of hair. One specimen shows a trace of several other very short pointed processes along the edges just below the tips.

FEMALE GENITALIA.—The three female genitalia examined all show at each side, above the ends of the genital plate, a fold not found in any other species examined. There also seems to be a vague trace of the pocket-like formations beside the ostium in two of the specimens examined.

I know nothing of the early stages of *homuraria*. It seems more southern in range than any other *Metarranthis,* all the specimens I have seen having come from an area extending from Virginia to Georgia, and west to Tennessee and Mississippi. Strecker's type of *amethystaria* is from Florida.

Metarranthis hypochraria (Herrich-Schäffer)

Epione hypochraria Herrich-Schäffer, Ausser. Schmett, 207, 208. 1855.

Endropia hypochraria (H.-S.), Guenée, Spec. Gén. IX, 125. 1857.

Endropia refractaria Guenée, Spec. Gén. IX, 125. 1857.

Endropia refractaria Gn., Walker, Cat. Brit. Museum XX, 151. 1860.

Endropia mestusata Walker, Cat. Brit. Museum XX, 154. 1860.

Macaria ? indeclinata Walker, Cat. Brit. Museum XXXIII, 888. 1861.

Azelina fœdaria Walker, Cat. Brit. Museum XXXV, 1548. 1866.

Endropia hypochraria (H.-S.), Packard, Mon. of Geom. Moths, 504; Plate XII, Fig. 12. 1876.

Azelina fœdaria Wlk., Packard, Mon. of Geom. Moths, 523. 1876.

Endropia hypochraria (H.-S.), Hulst, Ent. News VI, 15. 1895.

Gonodontis hypochraria (H.-S.), Holland, Moth Book, 350; Plate XLV, Fig. 1, ♂. 1903.

Entire upper surface of wings, grayish brown varying in intensity and ruddiness; antemedial line of fore wings distinct, curved, dark brown, followed by a darker shade; postmedial line distinct, dark brown, sharply angulate at vein M_2 of fore wings, correspondingly angulate on lower wings, preceded by a dark brown shade. (Actually this postmedial line is a double line, the two lines practically superimposed except near the angulation, where the inner line is curved, and the outer line forms the angulation. Ordinarily the dark shade completely obscures the inner

line, but in occasional pale specimens, usually females, both lines are distinctly visible.) Subterminal shade of dark spots more or less distinct but usually not conspicuous; fringes concolorous with terminal area, often darker at the ends of the veins; discal spots blackish, distinct on all four wings; outer margin of all wings somewhat indented between the veins, more in some specimens than in others. Under side pale gray or yellowish, usually considerably flecked with deeper yellow or rusty red; postmedial line usually distinctly double, the inner line reddish brown and curved, the outer one purplish and angulate. A very red form of this species is seen occasionally, which strongly resembles *homuraria,* but is distinguishable by the less deeply indented wing margins, the smoother and less mottled appearance of the upper side, and by the difference in the coloring of the under side, which in *hypochraria* consists of red scales on a pale yellowish background, which is sometimes almost, but never completely, covered with the red scales, while in *homuraria* the background is red and the sparsely scattered scales are dark brown or purplish. Expanse $1\frac{1}{4}$–$1\frac{1}{2}$ inches.

Male Genitalia.—Uncus of medium length, somewhat spatulate but bluntly pointed; valves rounded with a slight excavation, or at least a straightening of the margin along the upper part of the outer edge; left branch of furca variable in length but longer than the right in all cases observed, rounded at the tip, with a fringe of many sharp pointed processes at the tip and for some distance along the edges below. These processes are longer than in any other species of this group except *lateritiaria,* and much more numerous than in that species. There are often a few hairs visible among these processes, but no distinct tuft. Right branch of furca shorter and sharper, similarly fringed with pointed processes, the two or three at the tip being longest.

Female Genitalia.—Similar to *pilosaria.*

Egg.—Similar to other species, laid singly and attached to the surface of leaves or stems. After two or three days they turn bright carmine.

Larva, first stage.—Black, with six bands of white spots, the first one slightly narrower than the others.

MATURE LARVA.—About $1\frac{1}{2}$ inches long, more slender than the larvæ of the *obfirmaria* group, dark brown, inconspicuously mottled, and bearing two small pale oval spots, side by side, on the upper side of the fifth segment. The eleventh segment has the two usual tubercles rather prominent. Underneath there are three indistinct discontinuous longitudinal darker stripes, extending from the first abdominal segment to the prolegs on the ninth segment. The outer stripes spread farther apart just before the middle of each segment, and the inner stripe widens accordingly. The face is speckled black on pale gray, and bordered grayish white. Larvæ of this species seem subject to very little variation in color and pattern, at least in western New York. They will eat various *Rosaceæ,* and seem to do particularly well on choke cherry. I have seen a series bred by Dr. McDunnough upon blueberry.

RANGE.—Quebec to North Carolina and westward at least to Illinois and Wisconsin.

Metarranthis broweri new species

Endropia ‡ *hypochraria* Dyar, Ent. News V, 61, 1891 (description of early stages) (*nec hypochraria* H.-S.).

Gonodontis ‡ *hypochraria* Dyar, Psyche VIII, 415, 1899 (description of early stages) (*nec hypochraria* H.-S.).

Upper surface yellowish gray, varying in intensity, but rarely as dark as the palest *hypochraria,* and usually much paler; general pattern of the upper side similar to *hypochraria;* subterminal shade of yellowish brown spots usually present across all four wings. Fringes concolorous with terminal area, rarely darker at ends of veins, as shown in the male illustrated. Under side pale gray with a flecking of yellowish scales; dark transverse lines entirely missing or indicated only by a few brown or purple scales scattered along a paler band where the yellow flecking is interrupted; size and wing form similar to *hypochraria.*

MALE GENITALIA.—Similar to those of *hypochraria* except in the structure of the furca, which has much shorter pointed processes at the tip of each branch, and a distinct tuft of fine hairs at each tip, more prominent on the left branch than on the right one. There seems to be great variation in the length of the left branch of the furca, which is sometimes longer than in any *hypochraria* examined, and in other specimens no longer than the right branch. In this latter case, the male genitalia of this species strongly resemble those of *homuraria,* but the moths are so unlike in appearance that there is little danger of confusing them.

FEMALE GENITALIA.—Quite similar to those of *hypochraria.*

Egg.—Similar to that of *hypochraria,* and similarly attached.

Larva, first stage.—Similar to that of *hypochraria,* but with the first white band equal in width to each of the others. The head and prolegs tend to be whiter than in *hypochraria,* or in *franclemonti.*

Mature Larva.—About 1½ inches long, varying in color from pale straw yellow through rusty red to light molasses brown, sometimes with an elaborate pattern of markings on the upper side, or with a single dark stripe, or with no obvious pattern whatever. A great variety of colors and patterns sometimes occurs in the same lot of larvæ, but I have rarely seen any as dark as the ordinary *hypochraria* larva. The pattern of the under side seems quite constant, its most prominent feature being five distinct, unbroken, longitudinal dark stripes, the two outer ones close together and of quite uniform width and intensity, the middle one wider and less uniform. I have successfully reared several lots of larvæ on wild cherry. Dyar reported that they would eat persimmon, sassafras, and apple, but that they refused oak.

Broweri has consistently been mixed with *hypochraria* in collections, but it is very distinct not only in appearance, larva, and structure of male genitalia, but even in habits. In localities in western New York where both species are common, *broweri* appears regularly on the wing ten days or two weeks earlier than *hypochraria.* When I have kept pupae of both species over winter under identical conditions, the earliest *hypochraria* to emerge has always been later than the last *broweri.* For some time after I had become aware of the distinctness of the two species I had suspected the pale species of being *refractaria* Gn., but an examination of Guenée's type convinced me that that type is just what it has been reported, a pale and rubbed *hypochraria.*

Holotype.—♂, Richmond Gulf, Sardinia, N. Y., May 29, 1938 (L. R. Rupert). In U. S. N. M. collection (ex Rupert coll.).

Allotype.—♀, Horseheads, N. Y., June 5, 1939 (L. R. Rupert). In U. S. N. M. collection (ex Rupert coll.).

Paratypes.—9 ♂♂, Sardinia, N. Y.; 37 ♂♂, 28 ♀♀, Horseheads, N. Y.; 37 ♂♂, 10 ♀♀, Ithaca, N. Y.; 2 ♀♀, Newtown Battlefield State Park, Chemung Co., N. Y.; 7 ♀♀, McLean Res., Tompkins Co., N. Y.; 1 ♂, 1 ♀, Rock City, N. Y.; 1 ♂, Crosby, N. Y.; 1 ♀, Black Brook, N. Y.; 1 ♂, 2 ♀♀, Bear Mt., N. Y.; 1 ♂, Mansfield, Pa.; 1 ♀, New Brighton, Pa.; 1 ♂, East New York, L. I.; 1 ♀, Plainfield, N. J.; 2 ♂♂, Orange Mts., N. J.; 1 ♂, 1 ♀, Passadumkeag, Me.; 1 ♂, Jefferson, Me.; 2 ♀♀, Augusta, Me.; 1 ♀, Crystal Bog,

Me.; 1 ♀, Chelsea, Ottawa Co., Quebec. Dates of field specimens range from May to early July; part of the Horseheads series are bred specimens in April. These 151 paratypes are variously distributed in the U. S. N. M., Cornell University, Brower, Buchholz, Franclemont, and Rupert collections.

This species is named in honor of Dr. A. E. Brower whose cooperation and assistance in supplying material for examination have been of great value in the preparation of this article.

I desire at this time also to express my appreciation of the assistance given by others, not previously mentioned, who have helped in this work, particularly Dr. W. T. M. Forbes of Cornell University, Mr. Otto Buchholz of Roselle Park, N. J., Dr. J. H. McDunnough of the Canadian National Museum, Mr. A. K. Wyatt of Chicago, Ill., and Mr. Paul Bruggemann of Furness, Sas'k.

KEY TO THE SPECIES OF *METARRANTHIS*

1. Postmedial line preceded by a distinct dark shade on upper side 2
   Postmedial line not preceded by distinct dark shade on upper side 9
2. Postmedial line sharply angulate at vein M_2 of fore wings 3
   Postmedial line bluntly angulate, at or just below vein M_2 of fore wing, or with a slight outward curvature at this position only 5
   Postmedial line not angulate (may be almost straight or curved throughout its entire length) 7
3. Under side of wings smooth bright orange red with brown and purple lines and a scattering of dark brown or blackish scales.
   homuraria Grt.
   Under side not red; or, if red, only flecked or streaked with rusty scales on a paler background 4
4. Postmedial line distinct on under side, brown and/or purple.
   hypochraria H.-S.
   Postmedial line of under side absent or very obscure; entire moth pale.
   broweri new species
5. Under side of wings smooth bright orange red, with brown and purple lines and a scattering of dark brown or blackish scales.
   lateritiaria Gn.
   Under side not red; or, if red, only flecked with rusty scales on a paler background 6
6. Upper surface light grayish brown, with contrasting darker pattern.
   warneri Harv.
   Upper surface smoky brown, with less contrasting pattern.
   warneri race *cappsaria* new race

7. Under side of wings bright uniform red, dark brown and purple transverse lines ..... *pilosaria* Pack.
   Under side not red; or, if red, only flecked with rusty scales on a paler background 8
8. Upper side pale yellowish gray; fringes darker, at least at the base; postmedial line almost straight ..... *apiciaria* Pack.
   Upper surface somewhat darker; fringes not contrasting; postmedial line strongly curved ..... *duaria* race *septentrionaria* B. & McD.
9. Median area of all wings about the same color as rest of wings 10
   Median area distinctly paler than rest of wings 11
10. Postmedial line uniform in width on all wings, complete, continuous, reddish, slightly angulate on all wings ..... *franclemonti* new species
    Postmedial line broader near, but not at, inner margins of all wings, and/or incomplete, and/or broken at the veins, smoothly curved, grayish brown ..... *duaria* Gn.
11. Postmedial line straight, median area more or less bright orange yellow, basal and terminal areas of fore wings dark brown ..... *obfirmaria* Hbn.
    Postmedial line curved or somewhat angulate 12
12. Both upper and lower surfaces of wings coarsely flecked with darker scales, giving the wings a speckled appearance ..... *angularia* B. & McD.
    Wings very finely flecked with darker scales, having a smoother, powdery appearance ..... *franclemonti* new species (an occasional specimen)

KEY TO THE SPECIES OF *METARRANTHIS*, BASED ON MALE GENITALIA

1. Both branches of furca ending in a single sharp, slightly hairy point 2
   Both branches of furca tipped with more than one pointed process 3
2. Furca symmetrical ..... *franclemonti* new species
   Left branch of furca much longer than right branch; both branches sinuate ..... *apiciaria* Pack.
3. Uncus distinctly spatulate, rather short 4
   Uncus longer, and of more nearly uniform width 8
4. Furca with little or no hair at tips ..... *lateritiaria* Gn.
   Furca with considerable hair at the tips 5
5. Left branch of furca strongly recurved at tip ..... *pilosaria* Pack.
   Left branch of furca only slightly curved at tip, or quite straight 6
6. Furca symmetrical ..... *homuraria* Grt. (very rarely *broweri* new species)
   Left branch of furca longer than right 7
7. Pointed processes long, with scattered hair ..... *hypochraria* H.-S.
   Pointed processes short, with hair usually in a distinct tuft, at least at tip of left branch ..... *broweri* new species
8. Left branch of furca with distinct hair tuft; right branch with some hair ..... *angularia* B. & McD.
   Both branches of furca without hair at tip 9
9. Both branches with many pointed processes both at the tips and along the edges below ..... *duaria* Gn.

Pointed processes at the tips only 10

10. Two very sharp slender pointed processes, close together, at tip of each branch ..... *warneri* Harv.

Two shorter, stouter pointed processes, somewhat separated, at each tip, and often with a trace of other still shorter, blunter ones.
obfirmaria Hbn.

PLATE VII

Figure 1. *Metarranthis obfirmaria* Hbn., male genitalia; 1a, detail of left furca tip; 1b, detail of right furca tip; 1c, ædoeagus.

Figure 2. *Metarranthis warneri* Harv., male genitalia; 2a, detail of left furca tip; 2b, detail of right furca tip.

Figure 3. *Metarranthis duaria* Gn., male genitalia; 3a, detail of left furca tip; 3b, detail of right furca tip.

Figure 4. *Metarranthis angularia* B. & McD., male genitalia; 4a, detail of left furca tip; 4b, detail of right furca tip.

Figure 5. *Metarranthis franclemonti* new species, male genitalia; 5a, detail of left furca tip; 5b, detail of right furca tip.

Figure 6. *Metarranthis apiciaria* Pack., male genitalia; 6a, detail of left furca tip; 6b, detail of right furca tip.

Figure 7. *Metarranthis lateritiaria* Gn., male genitalia; 7a, detail of left furca tip (two drawings); 7b, detail of right furca tip.

Figure 8. *Metarranthis homuraria* Grt., male genitalia; 8a, detail of left furca tip; 8b, detail of right furca tip.

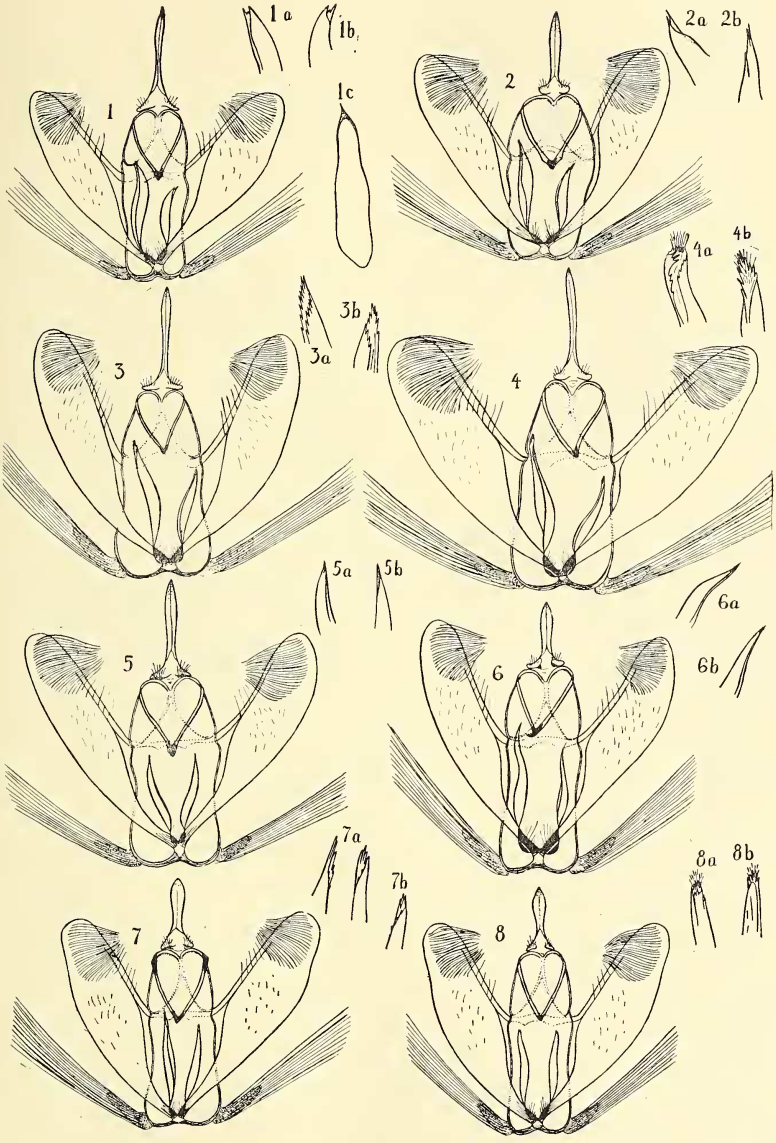
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PLATE VIII

Figure 1. *Metarranthis pilosaria* Pack., male genitalia; 1a, detail of left furca tip; 1b, detail of right furca tip.
Figure 2. *Metarranthis hypochraria* H.-S., male genitalia; 2a, 2b, details of left furca tips; 2c, 2d, details of right furca tips.
Figure 3. *Metarranthis broweri* new species, male genitalia; 3a, 3b, details of left furca tips; 3c, 3d, details of right furca tips.
Figure 4. *Metarranthis obfirmaria* Hbn., female genitalia.
Figure 5. *Metarranthis warneri* Harv., female genitalia.
Figure 6. *Metarranthis duaria* Gn., female genitalia.
Figure 7. *Metarranthis angularia* B. & McD., female genitalia.
Figure 8. *Metarranthis franclemonti* new species, female genitalia.
Figure 9. *Metarranthis apiciaria* Pack., female genitalia.
Figure 10. *Metarranthis pilosaria* Pack., female genitalia.
Figure 11. *Metarranthis lateritiaria* Gn., female genitalia.
Figure 12. *Metarranthis homuraria* Grt., female genitalia.
Figure 13. *Metarranthis hypochraria* H.-S., female genitalia.
Figure 14. *Metarranthis broweri* new species, female genitalia.

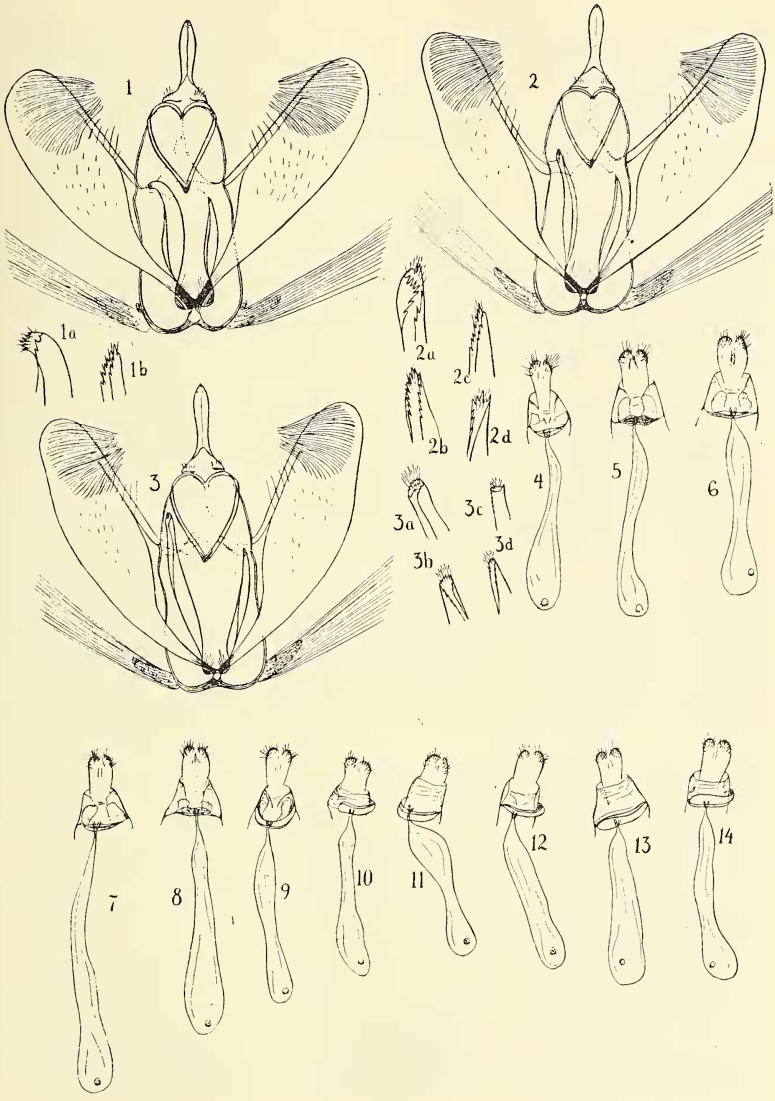
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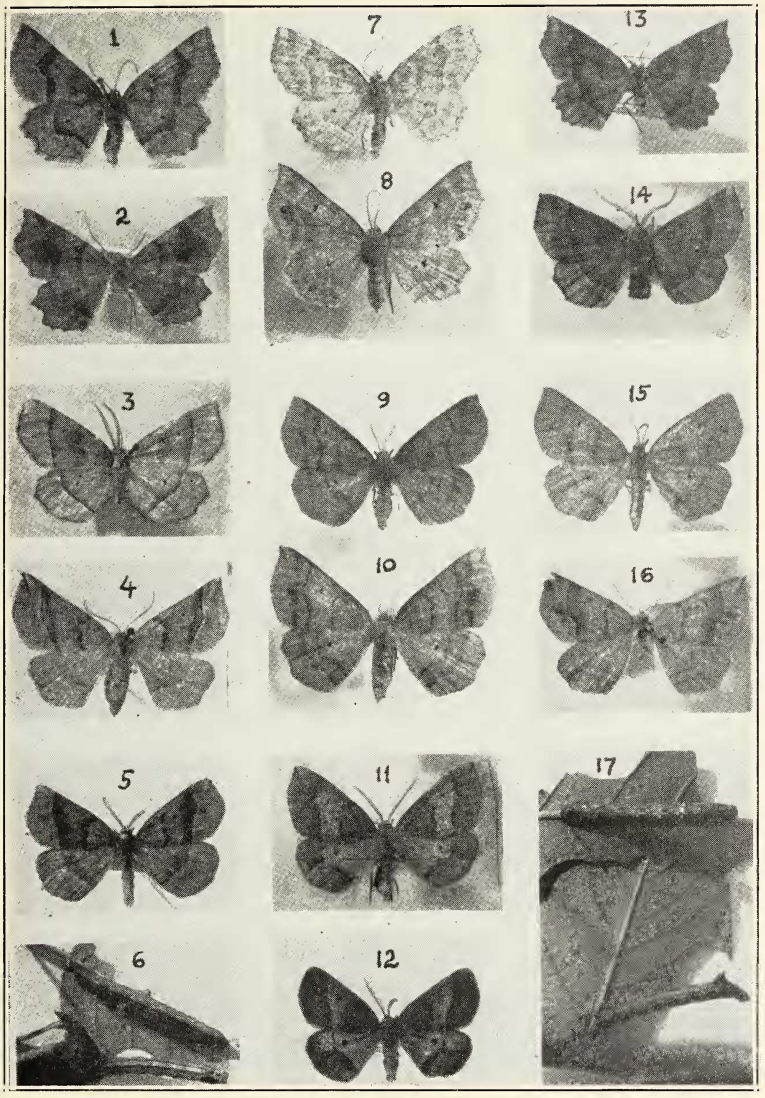
PLATE IX

Figure 1. *Metarranthis hypochraria* H.-S., ♀ (Horseheads, N. Y.).
Figure 2. *Metarranthis homuraria* Grt., ♀ (Richmond, Va.).
Figure 3. *Metarranthis apiciaria* Pack., ♂ (Elmwood, R. I.).
Figure 4. *Metarranthis warneri* Harv., ♀ (Augusta, Me.).
Figure 5. *Metarranthis warneri* race *cappsaria* new race, ♂ Holotype (Benlah, Man.).
Figure 6. *Metarranthis broweri* new species. Larvæ (Augusta, Me.).
Figure 7. *Metarranthis broweri* new species, ♂ (Horseheads, N. Y.).
Figure 8. *Metarranthis broweri* new species, ♀ (Horseheads, N. Y.).
Figure 9. *Metarranthis franclemonti* new species, ♂ (Horseheads, N. Y.).
Figure 10. *Metarranthis franclemonti* new species, ♀ (Horseheads, N. Y.).
Figure 11. *Metarranthis angularia* B. & McD., ♂ (Ithaca, N. Y.).
Figure 12. *Metarranthis obfirmaria* Hbn., ♂ (Horseheads, N. Y.).
Figure 13. *Metarranthis lateritiaria* Gn., ♀ (Kittery Point, Me.).
Figure 14. *Metarranthis pilosaria* Pack., ♂ (Lakehurst, N. J.).
Figure 15. *Metarranthis duaria* Gn., ♂ (Horseheads, N. Y.).
Figure 16. *Metarranthis duaria* race *septentrionaria* B. & McD., ♀ (Aylmer, Que.).
Figure 17. *Metarranthis franclemonti* new species. Larvæ (Horseheads, N. Y.).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